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winter kill the previous year. Cover crops were killed at least one month before planting cotton and rolled down on no-till plots or incorporated on conventional. All plots were paratilled each spring.

Paymaster PM 1220 BG/RR cotton seed was planted in May of each year, but was replanted in June '98 due to extremely dry weather. UNR (8 inch rows) plots were planted at 182,000 seeds/A and Wide Row (36 inch) plots at 84,000 seeds/A each year. Best known management systems, including growth regulators, were used for each system. The 1998 growing season was characterized by an extremely dry spring, followed by a moderate summer. This is in contrast to 1999, when the spring and early summer was wet, followed by an extremely dry late summer.

Plant Populations counts showed that UNR had a higher population in 1998 than Wide row @ P=0.10 (148,000 vs 38,000 plants/A). In 1999, there was an interaction between Tillage and Row width, with populations of 37,000 plants/A for Wide row vs 139,000 for conventional UNR and 98,000 for no-till UNR.

Leaf Area Index (LAI) measurements showed a significant (P= 0.10) Row width * Cover * Tillage interaction with UNR cotton consistently having a higher LAI than Wide Row at Early Bloom. In 1999, there was a Tillage * Row Width interaction, again with UNR having a much higher LAI at this growth stage.

Lint yield measurements showed that UNR systems yielded higher (911 vs 596 lb/A) than wide row in 1998, with no interactions. In 1999, there was a Tillage * Cover interaction, but no Row Width effect. Conventional tilled plots after legumes yielded 949 lb/A vs 865 lb/A for no-till after legumes. After rye, conventional yielded 923 lb/A and no-till 669 lb/A. It appeared that early season leaching and slow breakdown of cover crops in late season may have caused nitrogen deficiency in no-till rye plots.

Based on two years of data, it appears that UNR cotton took advantage of higher early season intercepted sunlight (LAI) to yield better than Wide Row cotton in a year with a dry early summer that slowed late season growth. In a year with a wet early spring and dry late summer, Wide Row cotton continued growth through late bloom and yielded the same as UNR. In that year, no-tilling decreased yields, while cover crops had a variable effect.

FARMING SYSTEMS FOR ULTRA-NARROW ROW COTTON

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Extended Abstract

Crop rotations are agronomically beneficial. Intensive cropping systems, using high-residue crops in rotations and coupled with conservation tillage, can dramatically improve soil quality and productivity. Unfortunately, economic reality often dictates cotton (*Gossypium hirsutum* L.) monoculture instead of rotations.

Recent research has shown that planting cotton with a grain drill in ultra-narrow rows (UNR) is a very promising production system. Other research at Auburn has shown that the tropical legume, sunn hemp (*Crotalaria juncea* L.), can be planted after corn (*Zea mays* L.) harvest and make 4000 lb/A residue and 120 lb N/A before the first killing frost. This N is readily available during the winter season and should be sufficient for a winter wheat (*Triticum aestivum* L.) crop. Sunn hemp has also been reported to suppress root-knot (*Meloidogyne spp.*) and reniform (*Rotylenchulus reniformis*) nematodes.

We established a study to compare an intensive cropping system, maximizing the production of crop residues and legume N inputs, to standard cotton production systems used in the Southeast. The maximization of crop residue production and use of legumes should improve soil quality and increase productivity in a relatively short time. The new system uses research results from sunn hemp and ultra-narrow row cotton in an intensive rotation with wheat and corn. The standard systems use continuous cotton (both standard 40-inch rows and ultra-narrow row) and a corn - cotton rotation. All systems are tested under conservation and conventional tillage. The specific objectives of the research are to: 1) develop a cotton production system that maximizes soil carbon inputs; 2) determine the impact of the system on soil quality and productivity; and 3) determine the most economically favorable cropping system compared to standard cotton production systems.

This experiment was initiated in August of 1997 with the planting of sunn hemp on a Compass sandy loam (coarse-loamy, siliceous, subactive, thermic Plinthic Paleudults) in east-central AL. The site had previously been a tillage study with a corn-soybean [*Glycine max* (L.) Merr.] rotation and a winter cover crop of crimson clover (*Trifolium incarnatum* L.) for the past 10 years. The previous study had conservation (no-tillage; with and without in-row subsoiling) and conventional (disk-chisel-disk-field cultivate; with and without in-row subsoiling) tillage variables. Prior to starting this cotton study, the entire area was non-inversion deep-tilled with a paratill.

Tillage treatments in the cotton systems study were arranged to maintain the integrity of the previous 10-years conservation and conventional tillage treatments. The experiment design was a split plot arrangement of treatments in a randomized complete block of four replications. Main plots were cropping systems and subplots were tillage, i.e., the previous conventional and conservation tillage treatments maintained. Cropping systems were: 1) intensive system; 2) cotton-corn rotation with 40-inch rows; 3) continuous cotton with 40-inch rows; and 4) continuous ultra-narrow (8-inch drill) cotton.

The intensive system maintains actively growing cash or cover crops about 360 days of the year. Corn is planted in early April and harvested in August; followed immediately by sunn hemp, which is terminated in early November when wheat is drilled. Ultra-narrow row cotton is drilled following wheat harvest in early to mid-June. Following cotton harvest in October, a white lupin (*Lupinus albus* L.)-crimson clover mixed cover crop is drilled for use by the following corn crop that starts another rotation cycle. In the continuous and corn-cotton rotation treatments, a black oat (*Avena strigosa* Schreb.) - rye (*Secale cereale* L.) cover crop mix is used prior to cotton and the white lupin-crimson clover cover crop is used prior to corn. All phases of each rotation are present each year in all cropping systems, to eliminate confounding year effects with system effects.

Paymaster 1330 BG/RR was planted at 50,000 seed/A for 40-inch cotton and drilled at 170,000 seed/A for ultra-narrow row cotton. Planting dates for 40-inch cotton and continuous ultra-narrow row cotton were May 11, 1998 and May 13, 1999. Planting dates for ultra-narrow row cotton in the intensive system were June 4, 1998 and June 18, 1999. All cover crops were killed 14-21 days prior to planting using glyphosate and a mechanical roller. Weeds were controlled with glyphosate over-the-top at 4-true leaves; in 1999 preemergence applications of fluometuron and pendimethalin were also applied. Nitrogen (120 lb N/A) was broadcast applied to ultra-narrow row cotton at planting and banded beside the row for 40-inch cotton. Standard row cotton was harvested with a spindle picker and UNR cotton was harvested with a stripper fitted with a finger harvester.

Both 1998 and 1999 rainfall were below average for the cotton growing season. Tillage affected cotton lint yield both years, but treatment rankings were reversed. Averaged over cropping systems, conservation tilled cotton yielded 623 lb lint/A compared to 596 lb lint/A with conventional tillage ($P \leq 0.03$) in 1998. In 1999, conservation tillage cotton yielded 513 lb lint/A and conventional tillage cotton yielded 563 lb/A ($P \leq 0.10$). The reduced yield with conservation tillage in 1999 was due to root-limiting soil compaction and the drought. In 1998, prior to starting the test, the plots were paratilled, but in 1999 they were not.

Cropping system effects also varied by year. Averaged over tillage systems, UNR cotton yields were similar in 1998 for the continuous cotton planted on May 11 (729 lb lint/A) and the cotton double-cropped with wheat in the intensive system (712 lb lint/A), planted on June 4. These yields were significantly greater ($P \leq 0.001$) than yields from 40-inch row systems. Yields were similar between 40-inch row systems, averaging 505 lb lint/A in the corn-cotton rotation and 491 lb lint/A for continuous cotton. In 1999, yields were statistically similar for all cotton planted on May 13, regardless of system. This includes the 40-inch corn-cotton rotation (577 lb lint/A), the 40-inch continuous cotton (566 lb lint/A), and the continuous UNR cotton (613 lb lint/A). Ultra-narrow row cotton double-cropped with wheat in the intensive system and planted on June 18 suffered more from the drought and lack of paratilling then that planted on May 13, and yields were reduced with this system (395 lb lint/A; $P \leq 0.04$).

Economic viability of tillage and cropping systems cannot be judged solely from cotton yields; costs and returns of all the cash and cover crops in the various systems must be included in the evaluation. We used Auburn University Extension Budgets, adjusted for differences in actual practices that varied from inputs in the standard budgets, to calculate net returns over variable costs for the cropping and tillage systems. We allowed a deduction for UNR cotton lint of $0.04/lb in calculations. Averaged over the two years, highest net returns over variable costs were obtained with continuous UNR cotton; although returns were highly variable, ranging from $29.28/A/year to $124.19/A/year. Lowest mean returns were from continuous 40-inch row cotton, averaging $27.09/A/year with conventional tillage and $20.97/A/year with conservation tillage, with a range of from -$1.45/A/year to $43.38 a year. Including corn in the rotation increased mean net returns ($37.70/A/year for conventional tillage and $32.47/A/year for conservation tillage) but also increased economic risk, based on the increased range of return (-$13.07/A/year to $88.03/A/year).

The intensive cropping system with conservation tillage had the second highest returns over variable costs, however, this system minimized variation in returns. Returns ranged from $58.04/A/year to $67.64/A/year with this system. Not only were net returns and risks favorable with this system, but this system returned over 6,500 lb carbon/A/year to the soil; compared to about 1,000 lb carbon/A/year for a conventional cotton production system without benefit of rotation or cover crops. Thus, this system, coupled with conservation tillage, has potential to rapidly increase soil organic matter; improving soil quality and productivity in the long term and further enhancing economic sustainability of cotton production in the Southeast.

EFFECTS OF POPULATION, ROW SPACING, AND NITROGEN FERTILIZATION ON LINT YIELDS OF NO-TILL COTTON

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Abstract

Cotton producers, due to current economic conditions, need to produce cotton more economically than they have in the past. They need to make less trips over the field and make the utmost use of their fertilizer dollar. One way of accomplishing this goal may be by using some form of the no-till system combined with an ultra narrow row production system. A study was conducted at two different locations to evaluate cotton lint yield response to four row spacings, four populations, and two nitrogen rates under no-till conditions. Results showed that row spacings, plant populations, and nitrogen rates had a direct effect on plant heights and lint yields at both locations.

Introduction

Research evaluating cotton response to different row spacings, plant populations, and nitrogen rates is important to improve regional technology useful to cotton producers in assessing costs of production and in increasing the conservation of soil and moisture. Studies with ultra-narrow row cotton (UNR) with varying populations and N fertilizer rates have shown to have a direct effect on cotton lint yields(Delaney, Monk, Reeves, Bannon and Durbin, 1999; McFarland, Lemon, Hons, and Gerik, 1999).

The purpose of this study was to determine the row spacing and plant density effect on certain cotton growth parameters and lint yields under no-till production systems and investigate possible interactive effects of plant densities with row spacings and N rates on growth parameters and lint yields.

Materials and Methods

Studies were conducted in 1999 at two different sites: Site A was located at the Texas A&M Agricultural Experiment Station at Corpus Christi, Texas, and Site B at the USDA-ARS Research Center at Weslaco, Texas, which is approximately 135 miles south-southwest of Corpus Christi. The soil type at the Corpus Christi site is an Orelia sandy clay loam (Hyperthermic Typic Ochraqualf); while at Site B, the soil was classed as Hidalgo sandy clay loam. Some characteristics of the surface horizon for the Orelia soil include: Sand content-60.2%, silt content-14.1%, clay content-25.7%, moisture retention at .1 bar-24.7%, and at .33 bar-18.2% (Stearman, Matocha, and Crenshaw, 1995). Surface horizon of the Hidalgo soil contained 56% sand, 19% silt, and 25% clay, with a pH of 8.0 and organic C of 1.1%.

This was the first year that no-till practices had been applied to this particular experimental field. In December 1998, a disc was used to lightly incorporate some of the previous crop residue and control weeds. On April 8, one quart of Roundup Ultra herbicide per acre was applied to control the light weed population. On April 9, Paymaster 1218 BGRR was planted and 1 1/2 pints Dual and 1 1/2 pints Cotoran preemergence herbicide was applied per acre. On May 7, an application of 1 1/2 pints Roundup Ultra per acre was applied.

The fertilizer was sidedressed with a spoke wheel injection system on May 28 approximately 6 inches deep and 4 inches to the side of the plant.